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MEMORANDUM

From/De : Louis Kluberg /PPE for the NA50 Collaboration
To/à : J. Nassalski (discussion convenor)
Subject/Sujet : Plans of the NA50 Collaboration
Copies : B. D'Almagne, chairman of SPSLC

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1. EXPERIMENT NA50

Experiment NA50 has successfully taken data with the 160 GeV per nucleon Pb beam during the 1994 ion beam period.

Most of the sub-detectors were ready in time and did perform as expected in the proposal. Those which, for parts delivery or shipping delays, could not be completely implemented or optimized showed promising features for their use in the next data taking periods.

The readout, acquisition and monitoring softwares allowed us to take data and monitor the detectors under good conditions. They still need improvements in order to be fully optimized and reach the nominal performance and desired stability.

Unforeseen problems were discovered during this exploratory run.

1. A significant amount of the observed dimuon trigger did not originate from our lead target. Therefore, several days were devoted to a whole set of special "technical runs" in order to fully understand the problem and be able to solve it in future runs, which is now the case. Although already correctly flagged during the 1994 run, most of this spurious triggers will be suppressed in future runs with the hardware changes we are implementing for 1995.

2. A low overall luminosity was the result of unsufficient target thickness together with a mismatch between our target dimensions and the optics which, eventually, we were forced to adopt in order to minimize our sensitivity to beam extraction instabilities. New appropriate targets will be used in the future providing a gain of a factor 4 in luminosity.

3. The intensity of the Pb beam on our targets was of the order of 2 10^7 ions per burst, a factor 2.5 below the nominal intensity requested in our proposal. We ask for the nominal intensity for the forthcoming ion runs.

4. An abnormal time-structure of the beam induced an unexpected amount of pile-up events. We would like to point out that this spill problem has to be solved or highly attenuated in the future in order to be able and make full use of the available intensity.

Under these conditions, the total sample of events collected for physics during the 1994 exploratory run was significantly below our expectations, although in agreement with the rates estimated in the proposal.

We thus conclude that, starting with the 1995 lead run and in order to reach our physics goals with the sensitivity described in detail in proposal P265, we need:

1. 70 days of Pb beam at 5 10^7 ions/burst for the J/ψ runs
2. 45 days of Pb beam at 5 10^7 ions/burst for the ϕ runs

At this point, it is worthwhile emphasizing that, according to our approved proposal P265, the total amount of beam mentioned above is requested:

1. at the highest energy available from the SPS since experiment NA50 cannot run with a low energy incident beam due to acceptance, rates and coherence reasons.

2. with a normal time-structure within the burst, which was not the case in 1994.

Starting with the ion runs of 1995, the requested beam time stays the same as stated in the proposal P265 and agreed in the NA50 Memorandum of Understanding. It could thus extend over a period of at least 3 years under usual scenarios, depending on the quality and intensity of the beam.

It is our wish to carry efficiently to its end the approved experiment NA50. The theoretical progress and new questions rised since the first observations made by experiment NA38, the scientific interest of the problem we are addressing, the important financial and human effort which has been already invested by the collaborating teams as well as the promising status of the detector deserve that the experiment will now be given the agreed experimental stable conditions for its successful completion.

2. A POSSIBLE FUTURE EXPERIMENT

As a still remote project, we would like to inform the Committee that we are investigating the possibility of another experiment suggested to us by H. Satz for which a proposal will be submitted in due time if we are able to prove its practical feasibility under reasonable experimental conditions.

The experiment is intended to study if, in fact, J/ψ suppression, as already observed by experiment NA38, can be really considered as a signature of quark-gluon plasma or if hadronic matter interactions could also induce such a suppression. The answer to this question can be inferred from theoretical considerations but experimental confirmation of non calculable assumptions is highly desirable. It is of extreme importance both for present experiments and for assessing the possibilities of future searches with high energy colliders.

The main lines of the proposed experiment are briefly presented hereafter.

In the frame of short distance QCD [1] calculations, it can be shown that only interactions with hard gluons are able to lead to J/ψ dissociation. On the other hand, it is known from deep inelastic lepton-hadron scattering that the momentum distribution of gluons in light hadrons is peaked at low momenta. It then follows that the inelastic J/ψ-nucleon cross-section is very small near threshold and reaches its asymptotic value at very high interaction energies [2] or, equivalently, that the absorption of J/ψ's in confined hadronic matter at reasonable temperature ($T \leq 0.5$GeV) is not possible [3]. The crucial point leading to this conclusion is the energy dependence of the J/ψ-hadron cross-section which, in the limit of very heavy quark masses, can be calculated in short distance QCD but which, for the real case of finite charm quark mass, has to be tested experimentally.

The idea is to measure the low energy interaction of the J/ψ with nucleons inside the nucleus using 160 GeV/nucleon Pb ions on hydrogen or deuterium targets [4]. High rapidity J/ψ's in the lab system, i.e. $3.6 \leq y_{\rm lab} \leq 4.6$, will thus be slow in the rest-frame of the fast moving incident Pb nucleus and undergo low energy collisions with the Pb nucleons.

The comparison with p-p interactions under the same kinematical conditions will allow to study J/ψ production in an unexplored kinematic region. Moreover, it will provide a test of short

distance QCD. Finally, by establishing if J/ψ's are or are not transparent when embedded in confined matter, it will answer the question of whether J/ψ suppression can be considered as an unambiguous deconfinement test or not.

From the technical point of view, the experiment seems within reach of the present NA50 detector after appropriate setup modifications. A similar technique has been used recently for the successful 45 days long NA51 experiment. It is still premature to say if, from the practical point of view, the experiment is feasible i.e. if a significant result could be obtained within a reasonable amount of beam-time, extending over a period of the order of 1 or 2 years. We expect more clear views on this point during this current year.

References

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